Issued September 25, 1912.

U. S. DEPARTMENT OF AGRICULTURE.

IMP. BU
23 APR. 1916
ENTOM.

FARMERS' BULLETIN No. 506.

FOOD OF SOME WELL-KNOWN BIRDS OF FOREST, FARM, AND GARDEN.

BY

F. E. L. BEAL AND W. L. McATEE,
Biological Survey.

WASHINGTON:
GOVERNMENT PRINTING OFFICE
1912.

LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Biological Survey,
Washington, D. C., May 14, 1912.

Sir: I have the honor to submit herewith and to recommend for publication as a Farmers' Bulletin a report on the food of some well-known birds of the forest, farm, and garden, by F. E. L. Beal and W. L. McAtee, assistants in the Biological Survey. These birds to the number of 20 have been selected because of their economic importance to the farmers and fruit growers of the respective regions they inhabit. With the exception of three species of sapsuckers, all the birds treated of are beneficial, and it is for the best interest of the farmer that he should be able to recognize these common birds at sight, so that he may protect the beneficial kinds and, when necessary, destroy the others. To facilitate identification, a number of illustrations are included.

Respectfully,

Henry W. Henshaw,
Chief Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

CONTENTS.

	Page.
Introduction	5
Three-toed woodpeckers (*Picoides arcticus* and *Picoides americanus*)	5
California woodpecker (*Melanerpes formicivorus bairdi*)	7
Lewis woodpecker (*Asyndesmus lewisi*)	8
Red-bellied woodpecker (*Centurus carolinus*)	10
Sapsuckers (*Sphyrapicus varius*, *Sphyrapicus ruber*, and *Sphyrapicus thyroideus*)	12
Hummingbirds (*Archilochus colubris* and *Calypte anna*)	15
Arkansas kingbird (*Tyrannus verticalis*)	18
Ash-throated flycatcher (*Myiarchus cinerascens*)	19
Western yellow-bellied flycatcher (*Empidonax difficilis*)	21
Horned lark (*Otocoris alpestris*)	23
Chipping sparrow (*Spizella passerina*)	25
Junco or snowbird (*Junco hyemalis*)	26
White-crowned sparrow (*Zonotrichia leucophrys*)	28
Southern butcher bird (*Lanius ludovicianus*)	29
Audubon warbler (*Dendroica auduboni*)	32
Ruby-crowned kinglet (*Regulus calendula*)	34

ILLUSTRATIONS.

		Page.
FIG. 1.	Arctic three-toed woodpecker	6
2.	California woodpecker	7
3.	Red-bellied woodpecker	10
4.	Yellow-bellied sapsucker	14
5.	Ruby-throated hummingbird	16
6.	Anna hummingbird	17
7.	Arkansas kingbird	18
8.	Ash-throated flycatcher	20
9.	Western yellow-bellied flycatcher	22
10.	Horned lark	24
11.	Chipping sparrow	25
12.	Junco or snowbird	27
13.	White-crowned sparrow	28
14.	Southern butcher bird	30
15.	Audubon warbler	32
16.	Ruby-crowned kinglet	34

FOOD OF SOME WELL-KNOWN BIRDS OF THE FOREST, FARM, AND GARDEN.

INTRODUCTION.

Besides the more common birds of the farm and garden treated in Farmers' Bulletin No. 54 there are others less familiarly known, or known only over a smaller area of country. Many of these are of great economic importance in the region they inhabit and are well worth investigation and study. In the following pages the food of twenty species is discussed in its relation to economic interests. The twenty species consist of 8 woodpeckers, 2 hummingbirds, 3 flycatchers, 1 horned lark, 3 sparrows, 1 butcher bird, 1 warbler, and 1 kinglet. Nearly 5,000 stomachs of these birds have been examined, and the general and most important results are embodied in these pages. Two species, the chipping sparrow and southern butcher bird, are found over the whole country in the breeding season, but migrate to more southern lands on the approach of winter. The snowbird, white-crowned sparrow, and ruby-crowned kinglet, on the contrary, make the United States their winter home, but retire farther north or to high mountain regions in the breeding season. The horned larks in some of their numerous geographical races occur at some time of the year in nearly all parts of the country, though their distribution in winter is very irregular and uncertain. With the exception of the sapsuckers, all of these species are more beneficial than injurious. As the sapsuckers do much damage, they should be clearly distinguished from the other woodpeckers, which are chiefly beneficial.

THREE-TOED WOODPECKERS.

(*Picoides arcticus* and *Picoides americanus.*)

The three-toed woodpeckers are residents of the Boreal zones of North America, in Alaska, Canada, the extreme northeastern United States, and in the mountains of the Western States, south to northern New Mexico and to central California. The two species, the Arctic three-toed woodpecker (*Picoides arcticus*) and the American three-toed woodpecker (*Picoides americanus*), including the subspecies of the latter, are so similar in food habits that they may be

treated together. All are residents of coniferous forests, from which they sometimes wander a short distance in winter.

The great bulk of the food of these birds consists of the larvæ of wood-boring beetles or moths. These are eaten with great regularity throughout the year, but somewhat more in the colder months than in summer. Unfortunately only 28 stomachs of *Picoides arcticus* (fig. 1) and 23 of *P. americanus* were available for examination. In the first analysis the food divides into 88.69 per cent of animal matter to 11.31 of vegetable for *arcticus*, and 94.06 per cent of animal to 5.94 of vegetable for *americanus*. The largest item for both species is wood-boring coleopterous larvæ. These amount to 64.25 per cent with *arcticus* and 60.66 with *americanus*. Caterpillars, which in this case are mostly wood-boring species, amount to 12.28 and 14.45 per cent for the two birds, respectively. This brings the total of wood-boring larvæ, including both caterpillars and beetles, up to 77.13 per cent for *arcticus* and 75.11 per cent for *americanus*, or more than three-fourths of the food of each species. Stomachs containing 15 to 20 of these grubs are common and one held 34. Probably the stomach is filled several times each day, and it does not seem unreasonable to assume that a bird will eat 50 of these insects every 24 hours for 6 months and at least 25 daily for the other half of the year. At this rate one bird will annually destroy 13,675 of these destructive grubs. Beetles other than wood borers amount to 3.41 per cent for *arcticus* and 10.39 for *americanus*. Ants constitute 6.35 per cent of the food of *arcticus* and 8.29 of that of *americanus*.

FIG. 1.—Arctic three-toed woodpecker.

Most of them are taken in spring and summer and none in winter. A few other insects and spiders amount to less than 1 per cent for each species and make up the remainder of the animal food.

Vegetable food.—The vegetable food of both species may be included in four items: Fruit, mast, cambium, and rubbish. Fruit skins were found in only 1 stomach of *americanus* and mast in but 1 of *arcticus*. Cambium, or the inner bark of trees, appeared in 10 stomachs of *arcticus* and 8 of *americanus*. Rubbish, principally rotten wood, occurred in 9 stomachs.

Summary.—The foregoing discussion of the food of the two species of *Picoides* shows that these birds act as "conservators of the forest" in the strongest sense, as three-fourths of their food consists of the direct enemies of forest trees. It is unfortunate that in most places three-toed woodpeckers are not very numerous, and for this reason they should be protected and encouraged in every way possible.—F. E. L. B.

FIG. 2.—California woodpecker.

CALIFORNIA WOODPECKER.

(*Melanerpes formicivorus bairdi.*)

The California woodpecker (fig. 2) is distributed throughout most of the oak-covered mountain and foothill region of California, northern Lower California, and western Oregon. It lives generally wherever large oaks are abundant, and from these it gets much of its living. A peculiar habit has attracted much attention among nonscientific observers—that of drilling holes in tree trunks or large branches, in each of which is placed an acorn or other nut. Where this bird is abundant all dead trunks or branches of any size, and many live ones, are punctured with these holes, frequently less than an inch apart. When trees in the proper condition are not numerous enough it attacks buildings and drills holes in the cornices of houses or spires of churches; also it bores into telephone and telegraph poles and fence posts.

For the laboratory investigation of the food of the California woodpecker 84 stomachs were available. The food was found to consist of 22.59 per cent of animal matter to 77.41 per cent of vegetable.

Animal food.—Beetles constitute the smallest item of the animal food. They amount to less than 3 per cent and are distributed among several families, with no preference shown for any one. In July, the only month in which they are at all prominent, they reach 14.76

per cent. No wood-boring larvæ were found. Ants amount to 8.09 per cent of the food. In the one stomach taken in March they constitute 50 per cent of the contents, but in no other are they an important element. Other Hymenoptera amount to 7.34 per cent, and more than half of these were contained in stomachs taken in August, in which month they aggregate 37.33 per cent. A few black olive scales and other bugs, some flies, and grasshoppers make up the remainder of the animal food—4.49 per cent.

Vegetable food.—Grain, fruit, and mast are the three items that compose the vegetable food. One stomach taken in January contained nothing but corn, and another collected in December contained nothing but a few corn hulls. This is the whole grain record and is of no economic interest. The average for the year is but little more than 1 per cent. Fruit amounts to a little less than 23 per cent. Most of it was the pulp of the larger cultivated varieties. The largest amounts were eaten in August and September, when they reached 59.34 and 54 per cent, respectively. Seeds of elderberries (*Sambucus*) were found in two stomachs and was the only fruit positively identified.

The principal item of food of the California woodpecker is acorns. This amounts to 53.30 per cent of the yearly diet and was found in 58 stomachs, or 69 per cent of the whole, and 23 contained nothing else. It is eaten in every month and attains its maximum of 93.58 per cent in November and its minimum of 29.47 in July. The question has been raised as to whether the bird stores the acorn for the sake of its meat or for the grub which may frequently develop therein. The examination of the stomachs removes all doubt, for while acorns are eaten frequently, larvæ are almost entirely wanting. Where almonds are largely cultivated and this bird is abundant it exhibits a strong liking for this nut and stores it instead of acorns in its holes. In some cases it has been found necessary to shoot the birds whenever they entered the orchard in order to save the crop.

Summary.—The foregoing shows that the food of the California woodpecker is not of much economic importance. It does not prey extensively upon the products of industry, except occasionally upon almonds, and its insect diet contains practically no useful species. Its worst sin is its propensity to puncture the cornices and casings of buildings and telegraph and telephone poles in order to store its nuts for winter use. This is a serious injury and will justify the destruction of the bird if no other remedy can be devised.—F. E. L. B.

LEWIS WOODPECKER.

(*Asyndesmus lewisi.*)

The Lewis woodpecker is irregularly distributed over that part of the United States west of the western edge of the Great Plains, north

to southwestern Canada and south to northern Mexico. It is by nature somewhat shy, not greatly addicted to visiting orchards or other cultivated areas.

In Oregon and Washington complaints have been made that the bird does damage to apples. Only twice was the writer able to find cases of serious injury. An orchard situated close to a river on the far side of which was a large area of wild land was so persistently visited by Lewis woodpeckers when early apples were ripening that the pickers had to shoot the birds in order to save the crop. One evening a number of boxes, filled ready for market, were left in the orchard. In the morning it was found that the woodpeckers had pulled out the wrapping paper from the cracks of several of the boxes and pecked the fruit so that it was necessary to open and repack them.

For the investigation of this bird's food 59 stomachs were available. They are so irregularly distributed over the year as to make a satisfactory study of the food impossible. Animal matter amounts to 37.48 per cent and vegetable to 62.52 per cent.

Animal food.—Predaceous beetles were eaten to the extent of 6.72 per cent, and, as is usually the case, appear to have been taken mostly in the spring and early summer. Other beetles amounted to 2.40 per cent and were all eaten in the five months from June to October. Among them were several blister beetles (Meloidæ). There is nothing in the stomachs to indicate that this bird ever digs into wood, decayed or otherwise, in search of beetle larvæ.

Ants were eaten most in summer and in April. June appears to be the month of maximum consumption, while May shows none. The average for the year is 11.87 per cent. Other Hymenoptera reach 11.57 per cent. Hemiptera, or bugs, seem to be taken very sparingly, and those chosen were of the larger species. They amount to 1.36 per cent. Grasshoppers are eaten—not many in August, more in July, and most in September, with a trace in October. The average for the year is 3.20 per cent. No caterpillars or Lepidoptera of any form were found in this bird's stomach. A few spiders amount to less than 1 per cent.

Vegetable food.—Corn was found in one stomach taken in August and constituted 62 per cent of its contents, but amounted to only 0.46 per cent of the food of the year. No other grain was found. Pulp and skins of fruit, probably cultivated, were noted in March, the three summer months, and October. The aggregate for the year was 10.90 per cent. Wild fruit was identified in 26 stomachs, all taken in July, August, and September. In the former it amounted to over 63 per cent of the food and the average for the year was 14.65 per cent. Six genera (*Amelanchier*, *Ilex*, *Cratægus*, *Cornus*, *Prunus*, and *Sambucus*) were identified. Mast (acorns) was the

largest item of food. It was found in 20 stomachs and constitutes 34.46 per cent of the diet. One stomach taken in December contained 75 per cent of this food. Seeds of poison oak (*Rhus diversiloba*) and a weed (*Amaranthus*) made up 2.05 per cent, the remainder of the vegetable food.

Summary.—The animal food of this bird has no special significance either way. It does not damage grain, but has a pronounced taste for fruit, which at present is gratified mostly by wild species, but if these are ever replaced by cultivated species in the bird's range it will probably turn its attention to the domestic varieties.—F. E. L. B.

RED-BELLIED WOODPECKER.

(*Centurus carolinus.*)

The red-bellied woodpecker (fig. 3) ranges over the eastern United States as far west as central Texas and eastern Colorado and as far

FIG. 3.—Red-bellied woodpecker.

north as New York, southern Ontario, Michigan, and southern Minnesota. It breeds throughout this range and appears to be irregularly migratory. It appears to go north of its breeding range sometimes to spend the winter. Four stomachs, collected in November and December, were received from Canada, and in eight years' residence in central Iowa the writer found the species abundant every winter, but never saw one in the breeding season. It is rather more of a forest bird than some of the other woodpeckers, but is frequently seen in open or thinly timbered country. In the northern part of its range it appears to prefer deciduous growth, but in the South is very common in pine forests.

In Florida the bird has been observed to eat oranges to an injurious extent. It attacks the overripe fruit and pecks holes in it and sometimes completely devours it. The fruit selected is that which is dead ripe or partly decayed, so it is not often that the damage is serious. The bird also sometimes attacks the trunks of the orange trees as well as others and does some harm.

For the investigation of the food of the red-bellied woodpecker 271 stomachs were available. In the first analysis the food was found to consist of 30.94 per cent of animal matter to 69.06 of vegetable. The former consists of insects and spiders, with a few tree frogs and lizards, while the latter may be considered as made up of grain, fruit, and mast.

Animal food.—Predatory beetles amount to 0.86 per cent and consist of some of the larger genera. Other beetles, all more or less harmful, aggregate 9.32 per cent of the food. Six species of weevils or snout beetles were identified and 14 individuals were taken from one stomach. There were also a number of wood-boring larvæ, which must have been dug out of the wood, thus benefiting the forest. Beetles form a pretty steady article of diet, and, starting with 3.62 per cent in January, they increase with fair regularity to May, when they attain the maximum of 27.57 per cent, from which they slowly decrease to 1 per cent in December.

Ants are eaten to the extent of 6.45 per cent of the food and are a fairly constant article of diet. The most are taken during the warmer months. Evidently this bird does not dig all the ants which it eats from decaying wood, like the downy woodpecker, but, like the flickers, collects them from the ground and the bark of trees. Other Hymenoptera amount to 1.45 per cent. Orthoptera (grasshoppers, crickets, cockroaches, etc.) constitute 5.89 per cent of the food. They were found in 51 stomachs, grasshoppers in 27, eggs of cockroaches in 15, crickets in 8, and a mantis (devil's rearhorse) in 1. Two stomachs contained the eggs of grasshoppers. Cockroaches were represented entirely by their egg cases (oötheca). Hemiptera, or bugs, amount to 1.86 per cent of the food and form a small but fairly regular constituent of the monthly diet. Scales were found in one stomach, but most of the bugs eaten were of larger species and the majority were Pentatomidæ, or stink bugs. Caterpillars were taken with considerable regularity and averaged 2.88 per cent of the diet. A few of them were identified as wood borers. Spiders and millipeds, with a few doubtful insects and small vertebrates, made up 2.29 per cent, the remainder of the animal food. Spiders are eaten at all times, but in trifling quantities. Small tree frogs were found in 9 stomachs and remains of lizards in 2.

Vegetable food.—Corn was the only grain found. It was contained in 39 stomachs and rather irregularly distributed through the year.

The great bulk was eaten in the three winter months and in March and September. The total for the year is 3.99 per cent. Fruit amounts to 27.28 per cent and forms a notable percentage of the food in every month. The month of greatest consumption is August, with 64.10 per cent, while April shows the least, 7.50 per cent. The larger part of this consists of wild fruit, of which 23 species were identified. What was thought to be apple pulp was found in one stomach, cultivated grape in one, and blackberry or raspberry in one. No great preference was shown for any one species of wild berry, but mulberries, woodbine, fox grapes, and sour gum were most commonly found.

Mast amounts to 30.70 per cent and is the largest item of food. Acorns, beechnuts, hazelnuts, and pecans make up most of this item. It was found in 178 stomachs and is eaten throughout the year, except in the three summer months. The greatest consumption appears to be in November, when it reaches 67.05 per cent of the month's food, and it does not fall much below this figure until spring. This record of mast eating is the largest of any bird of the family, except the California woodpecker. Poison ivy seeds amount to 2.15 per cent and are eaten in every month from August to February, inclusive.

Summary.—Only one element in the food of the red-bellied woodpecker has much economic significance. The bird shows a decided taste for fruit and may do injury, as it has in the Florida orange groves. The contents of the stomachs, however, show that wild fruits are preferred, and probably only when these have been replaced by cultivated varieties is any mischief done.—F. E. L. B.

SAPSUCKERS.

(*Sphyrapicus.*)

Of the 23 species of woodpeckers of the United States three only are properly classed as sapsuckers. These birds have short, brushy tongues not adapted to the capture of insects, while the other woodpeckers have tongues with barbed tips which can be extended to spear luckless borers or other insects whose burrows in the wood have been reached by their powerful beaks. The sapsuckers practically do not feed on wood borers or other forest enemies. Their chief insect food is ants. About 15 per cent of their diet consists of cambium and the inner bark of trees, and they drink a great deal of sap.

The parts of the tree injured by sapsuckers are those that carry the rich sap which nourishes the growing wood and bark. It is evident, therefore, that the bird's attack on trees may have serious results. When a small proportion of the bark and cambium are removed, the vitality of the tree may only be lowered, or branches

here and there may be killed. When the injury is more extensive, as it often is, the tree may be completely girdled, and of course dies. Holes made by sapsuckers go clear through the bark and often into the wood. Generally they are made in rings, or partial rings, around the trunk or limbs, but they often fall into vertical series, and they may be either vertically or horizontally connected. This type of woodpecker work is familiar to everyone who has been much in orchards and woods.

Sapsucker pecking disfigures ornamental trees, giving rise to pitch streams, gummy excrescences, and deformities of the trunks. Small fruit trees, especially apple, are often killed, and whole young orchards have been destroyed by these birds. Sapsuckers are known to attack no fewer than 258 kinds of trees, shrubs, and vines in the United States, 63 of which are often seriously injured and 32 have been killed.

However, the killing of trees outright is by no means the greatest damage done by sapsuckers. Indeed, in the aggregate these birds inflict much greater financial loss by producing defects in the wood of the far larger number of trees which they work upon but do not kill. Blemishes reducing the value appear in the lumber from such trees and in the various articles into which it is manufactured. These defects consist of distortion of the grain, formation of knotty growths and cavities in the wood, extensive staining, fat streaks, resin deposits, and other blemishes. All of these result from injuries to the cambium, their variety being due to differences in the healing.

Hickory trees are favorites of the sapsucker and defects in the wood, though severe, may be used to illustrate the general character of this form of damage and also the resulting loss. Blemishes in hickory due to sapsucker work consist of open black checks, varying in size up to two by four inches, sometimes walled with rotten wood or partly filled with spongy growth, and frequently connected with gnarly fissures, up to two inches in length, which usually extend toward the bark. These are surrounded by brown or black stains, called iron streaks, which penetrate more or less wood adjoining the wound and follow the grain sometimes for many feet, making conditions favorable for checking and rendering the wood harder to work. The abundance and extensiveness of stains and gnarly growth in hickory spoil the wood for many of its most important uses. A large proportion of hickory trees are attacked by sapsuckers, and it is estimated that about 10 per cent of the merchantable material is left in the woods on account of bird pecks. On this basis the annual loss on hickory is about $600,000. To this must be added the loss on timber graded out by the manufacturer and that suffered by the manufacturer himself because of culling out a certain proportion

of the finished product on account of the appearance of bird pecks unnoticed before.

It has been found that sapsucker work unfits for use such important ornamental woods as mahogany, black walnut, white oak, yellow poplar, chestnut, cherry, sweet gum, and hard maple; that it seriously blemishes woods prized for particular qualities, such as ash, basswood, cypress, red cedar, holly, buckeye, dogwood, and hickory; and that it sometimes destroys the value of wood even for heavy construction, as southern basswood, Engelmann spruce, and western hemlock. Defects due to sapsucker work have been found in the wood of 174 species of trees. In 90 of these they at times become so

FIG. 4.—Yellow-bellied sapsucker.

serious as to spoil the appearance or workability of the wood, and in 22 species they render the wood useless, except for coarse construction or for fuel.

It is evident that sapsuckers do not deserve protection. One of the three species—Williamson's sapsucker—on account of its preference for mountainous regions, takes little or no part in the damage above detailed. The other two species, bird for bird, are probably equally injurious. The red-breasted sapsucker lives west of the Rocky Mountains and is the only woodpecker of that region that has the whole head and throat red. The yellow-bellied sapsucker (fig. 4) of transcontinental range is the only woodpecker having the

front of the head (i. e., from bill to crown) red in combination with a black patch on the breast. From 4 to 11 species of woodpeckers other than sapsuckers occur in various sections of the United States. A majority of woodpeckers seen are not sapsuckers and great care should be taken to distinguish them.

The method of destroying sapsuckers that threatens least danger to other birds is poisoning. Mix thoroughly an eighth of an ounce of powdered strychnine (the alkaloid) with one pint of honey or other thick sirup. Apply to the injured tree just above rows of fresh punctures. Poison may be administered also by putting small pinches of the powdered strychnine directly into the freshest sap pits.—W. L. M.

HUMMINGBIRDS.

Hummingbirds are popularly supposed to live upon the nectar of flowers, and unquestionably this substance forms an important part of their food. Close observation has shown, however, that these little birds do not visit flowers wholly for the purpose of gathering honey, nor do they obtain all their food from flowers. The writer has observed them hovering in front of a cobweb, picking off insects and perhaps spiders entangled in the net. They have also been observed to capture their food on the wing, like flycatchers. Stomach examination shows that a considerable part of their food consists of insects and spiders, with sometimes a very little vegetable matter.

Only one species of hummingbird inhabits the eastern part of the United States. This is the ruby-throat (*Archilochus colubris*) (fig. 5), which is more or less common almost everywhere in that region. The writer has seen 100 of these tiny creatures hovering about the flowers of a buckeye tree, and this number was maintained all day and for many days, though the individuals were going and coming all the time.

In order to obtain definite knowledge as to the food of hummingbirds in general, and the ruby-throat in particular, 59 stomachs of this species were examined. Although the humming birds are the smallest of the avian race, their stomachs are much smaller in proportion to their bodies than those of other birds, while their livers are much larger. This would indicate these birds live to a considerable extent upon concentrated sweets, as stated above, and that the insects, spiders, etc., found in the stomachs do not represent by any means all their food. The quantities of food found in these tiny stomachs are so minute and the insects comprising them are so small that identification is very difficult and uncertain, but it is believed that the following statements do not contain any serious errors.

The animal food formed 94.32 per cent of the whole, and what was taken for vegetable matter made up the remainder, 5.68 per cent.

Animal food.—The principal item of insect food was small Hymenoptera, of which a large proportion are probably parasitic species. They amount to 36.32 per cent of the food, and next to spiders are the largest constituents of the animal diet. Hemiptera stand next to Hymenoptera among the insects eaten and amount to 8.88 per cent of the food. Many of these appear to be minute leaf hoppers (Jassidæ) or members of some closely allied family. Diptera (gnats) were found in only a few stomachs. They amount to only 2.57 per cent of the food. The largest component of the ruby-throat's food, however, is spiders, which amount to 43.46 per cent of the stomach contents.

FIG. 5.—Ruby-throated hummingbird.

Vegetable food.—Four stomachs held what was thought to be fruit pulp, one contained plant hairs felted into a solid mass, one held what appeared to be pieces of a seed, and one contained a few bits of rubbish. Altogether, vegetable food amounts to 5.68 per cent of the whole, and it is doubtful if any of it is taken intentionally.

As a representative of the western members of this family, the Anna hummer (*Calypte anna*) (fig. 6) has been selected. Of this species 111 stomachs were examined, and in some respects the food was found to differ noticeably from that of the ruby-throat. The largest item of animal food is Diptera (gnats or small flies), which

amount to 45.23 per cent and replaces the spiders so characteristic of the ruby-throat's diet. Hymenoptera, on the other hand, are nearly the same (35.03 per cent) as in the other species. Hemiptera (bugs) amount to 17.30 per cent, or nearly double what the ruby-throat had eaten. The Anna hummer had eaten spiders to the extent of only 2 per cent. A few bits of beetles were found in both species; also a few fragments of what was supposed to be the skin of a caterpillar. Only a trace of vegetable matter, presumed to be fruit pulp, was found in the stomachs of the Anna.

FIG. 6.—Anna hummingbird.

Summary. — The food of these two representatives of the hummingbird family, it appears, possesses but little economic interest, and that little is mostly in the wrong direction. The Hymenoptera eaten are probably largely parasitic species and so to be reckoned as useful, while the Diptera and spiders may be considered as neutral, although it is possible that some of the former may be of the gall-gnat family and so be harmful. The Hemiptera eaten are probably mostly of injurious species. On the other hand, hummingbirds do no harm to any product of husbandry and, as they are beautiful and interesting creatures, their preservation may well be urged on purely sentimental grounds.—F. E. L. B.

50679°—Bull. 506—12——3

ARKANSAS KINGBIRD.

(*Tyrannus verticalis.*)

The Arkansas kingbird (fig. 7) occupies during the breeding season the western portion of the United States from the Pacific Ocean eastward as far as Minnesota, Kansas, and Texas, though stragglers have been taken at points much farther east. It extends northward into southern British America, where it breeds, but in winter it retires southward entirely beyond the boundaries of the United States. It is a bird of the open country and avoids forests. A hilly country with frequent trees for nesting sites appears to be the most satisfactory location. It is said that it takes kindly to civilization and will live in the vicinity of gardens and buildings and in some cases will place its nest upon the structures of man, but in general it is at present far less domestic than its eastern relative.

FIG. 7.—Arkansas kingbird.

For the investigation of the food of the Arkansas kingbird 109 stomachs were available. The food was found to consist of 90.61 per cent of animal matter to 9.39 per cent of vegetable.

Animal food.—Beetles of all kinds amount to 17.02 per cent of the food and include 5.47 per cent of useful species, mostly Carabidæ

(ground beetles) and Cicindelidæ (tiger beetles). The remainder, 11.55 per cent, are all either harmful or neutral. Hymenoptera (bees and wasps) are the largest item of animal food and amount to 31.38 per cent. They form a good percentage of the food in every month except August, when they are partially replaced by grasshoppers. Honey bees (*Apis mellifera*) were found in 5 stomachs. In all there were 31 bees, of which 29 were males, or drones, and 2 were workers. This bird has been accused of eating honey bees to an injurious extent, but this seems hardly borne out by stomach examination. Hemiptera (bugs) amount to 5.36 per cent of the food. They belong to the families of stink bugs, leaf bugs, cicadas, and shield bugs. Diptera (flies) constitute 0.55 per cent of the diet. Evidently this flycatcher does not catch many flies. Lepidoptera, in the shape of adult moths and caterpillars, amount to 7.31 per cent and, when eaten at all, form a good percentage of the food, but they are entirely absent from the diet of several months.

Orthoptera (grasshoppers and crickets) stand next to Hymenoptera in the diet of the Arkansas kingbird, and form 27.76 per cent of the year's food. August is naturally the month of greatest consumption, when they amount to 61.58 per cent of the diet. It is a curious fact that several western species of flycatchers—birds that feed mostly on the wing—eat more grasshoppers than do those ground feeders, the meadow lark, and blackbirds. The orthopterous food consists mostly of grasshoppers, with very few crickets. Dragonflies and a few other insects, millipeds, and spiders, the bones of tree frogs in 3 stomachs, and eggshells, apparently of domestic fowl, make up the remainder of the animal food, 1.23 per cent.

Vegetable food.—Vegetable food amounts to 9.39 per cent, but presents very little veriety. Only 4 fruits and a few seeds were found. Seeds and skins of elderberries (*Sambucus*) were found in 11 stomachs, woodbine (*Psedera*) in 2, hawthorn (*Cratægus*) in 1, and an olive in 1, with skins and pulp not further identified in 2.

Summary.—The vegetable food of the Arkansas kingbird is of slight economic interest. Its only animal food that is open to criticism is the useful beetles, but these are more than counterbalanced by the harmful insects eaten.—F. E. L. B.

ASH-THROATED FLYCATCHER.

(*Myiarchus cinerascens.*)

The ash-throated flycatcher (fig. 8) occupies the western part of the United States from the Pacific Ocean as far east as Texas and Colorado and as far north as Washington. Like the kingbirds, it is a bird of the open parklike country and is particularly partial to the vicinity of abandoned ranches, in whose buildings it is pleased

to build its nest, while it forages in the orchard and about the deserted garden and cattle yards. Normally it makes its nest in natural cavities in trees and in the abandoned holes of woodpeckers.

In the determination of this bird's food only 90 stomachs were available, all taken in the months from April to December, inclusive. So few stomachs, spread over so long a time, can but give general ideas as to the food, and conclusions drawn therefrom must be considered as only tentative. The stomach contents were found to consist of 92.32 per cent of animal matter to 7.68 per cent of vegetable.

FIG. 8.—Ash-throated flycatcher.

Animal food.—Among the flycatchers the ash-throat is one of the lesser eaters of beetles. Beetles aggregate only 7.26 per cent, and, of these, 2.15 per cent can be considered as of useful species. These last consist of predaceous ground beetles (Carabidæ) found in 3 stomachs, and a ladybird (Coccinellidæ) found in 1 stomach. Other beetles, belonging to 7 different families, were found in 60 stomachs, or two-thirds of the whole number. Hymenoptera amount to 26.94 per cent and are the largest item of animal food. Wild bees and wasps make up the bulk of this item, with a few of the parasitic species. No honey bees were found.

Hemiptera (bugs) amount to 20.11 per cent. Among them were many of those queer beechnut-shaped little bugs called tree hoppers (Membracidæ). Stink bugs (Pentatomidæ) were found in 13 stomachs, cicadas in 13, jumping plant lice (Psyllidæ) in 7, shield bugs (Scutelleridæ) in 1, leaf hoppers (Jassidæ) in 7, assassin bugs (Reduviidæ) in 1, and negro bugs (Corimelænidæ) in 1.

Diptera (flies) amount to 12.83 per cent of the food. Those identified belong to the house-fly family (Muscidæ), the Syrphidæ, and the robber flies (Asilidæ). Altogether Diptera were found in 24 stomachs. Lepidoptera (moths and their larvæ) amount to 17.11 per cent of the seasonal diet and were found in 29 stomachs. Of these, 22 contained caterpillars and 7 held moths. Orthoptera (grasshoppers and crickets) were eaten in the first four months—i. e., from April to July—and a few in December. The total is only 5.14 per cent. Raphidians, dragonflies, and spiders together make 2.93 per cent, the balance of the animal food. Dragonflies were found in 6 stomachs and spiders in 17.

Vegetable food.—The vegetable food of the ashy-throat can all be summed up in two words—fruit and seeds. Elderberries (*Sambucus*) were found in 5 stomachs, *Cissus* in 1, black nightshade (*Solanum*) in 1, fruit not identified in 2, and seeds unknown in 3.

Summary.—In foraging for its animal food the ashy-throat destroys a great many harmful insects and a few useful ones, so that the balance is decidedly in favor of the bird as a useful economic factor. The vegetable food has no economic interest.—F. E. L. B.

WESTERN YELLOW-BELLIED FLYCATCHER.

(*Empidonax difficilis.*)

The western yellow-bellied flycatcher (fig. 9) occupies the western part of the United States from the Pacific coast eastward as far as the eastern foothills of the Rockies and as far north as Alaska. It is found in its summer range about 8 months of the year and during winter in Mexico. While somewhat fond of the darker shades of the forest, it takes kindly to the open when other conditions suit, and since the advent of civilization and the planting of orchards it finds these places quite to its mind as foraging grounds. The nest is usually under cover, but that appears to be the only condition. A hollow tree, a bracket under the porch of a house, a beam under a bridge, a crevice among the roots of an overturned tree, or under the overhanging turf of the bank of a stream are probably fair samples of locations.

For the study of this bird's food 150 stomachs were available. They were taken in every month from March to October and are very fairly distributed in time, but not so well in space, as most of them

were taken in California. The food was found to consist of 99.31 per cent animal matter to 0.69 per cent of vegetable.

Animal food.—Useful beetles amounted to 2.45 per cent of the food and consisted of predaceous ground beetles (Carabidæ) found in 8 stomachs, and ladybirds (Coccinellidæ) in 24. This would seem to indicate that this bird has a decided taste for coccinellids, though the percentage was not large. Other beetles amounted to 5.94 per cent, and were eaten quite regularly through the season. The weevil genus *Balaninus*, or the nut destroyers, was found in 8 stomachs, and several other harmful species were identified. Hymenoptera amounted to 38.76 per cent and were found in 121 stomachs, of which 7 contained no other food. They were mostly wasps and bees, though ants were found in 19 stomachs and entirely filled one of them. But few parasitic species were found.

FIG. 9.—Western yellow-bellied flycatcher.

Hemiptera were found in 53 stomachs, of which 2 contained nothing else. They amounted to 8.44 per cent of the food and consisted of stink bugs, tree hoppers, and leaf hoppers. The 2 stomachs that contained Hemiptera alone were entirely filled with stink bugs. Diptera were the second largest item of food and were eaten in every month and more regularly than any other. They were found in 67

stomachs and in 5 there was nothing else. They aggregated 31.27 per cent of the food. Lepidoptera amounted to 6.59 per cent of the diet. They consisted of moths found in 8 stomachs and caterpillars found in 31. It is worthy of note that larvæ of the codling moth (*Carpocapsa pomonella*) were found in 3 stomachs and were probably contained in a number of others, but not recognizable. It is not impossible that some of the adult moths were of this species also, but too badly crushed for identification. Orthoptera were found in 2 stomachs and amounted to 0.62 per cent of the food. Raphidia and a few unidentified insects made up 0.71 per cent. Spiders were contained in 20 stomachs and amounted to 4.48 per cent, the remainder of the animal food.

Vegetable food.—Vegetable matter was found in 19 stomachs. In 1 were a few seeds of *Rubus* (blackberry or raspberry), in 9 were seeds of *Sambucus* (elderberry), and in 2, skins of fruit not further identified; in 1, a seed of tar weed (*Madia*), and in 7, rubbish.

Summary.—In the foregoing discussion of the food of the western yellow-bellied fly-catcher it is evident that its good qualities far outweigh the bad—if indeed it can be said to have any bad ones. It eats predaceous beetles, but the percentage is so small that no great harm can be done. The other insects are mostly those that we are glad to lose. On the other hand, the bird is too small to injure fruit or grain, and it is of a confiding and domestic nature, inclined to live about the abodes of man, where it can do the most good.—F. E. L. B.

HORNED LARK.

(*Otocoris alpestris.*)

Horned larks (fig. 10) are small but hardy birds which frequent the open country and never live in forests. They range over practically the whole United States and are easily recognized by the conspicuous black mark across the breast and the small pointed tufts of dark-colored feathers behind the eyes. These are often erected and cause the appearance referred to in the common name. These birds nest early, often before all the snow has disappeared, and they have a joyous flight song in the mating season.

The food of horned larks, exclusive of those of southern California, consists of 20.6 per cent of animal and 79.4 per cent of vegetable matter. Not quite a sixth of the vegetable food is grain, mostly waste, though some sprouting grain is pulled. This is the most serious charge against the birds and is sustained, but it must be admitted that practically all the complaints were made years ago, when broadcast sowing was the rule. Recent correspondence shows that drilled grain is practically safe from injury.

Weed seeds are by far the largest single component (63.9 per cent) of the food of horned larks, and over 10 per cent of the 1,154 birds examined had eaten them, no fewer than 206 individuals having fed on them exclusively. Conspicuous among the weed seeds eaten are those of the foxtail grasses, smartweeds, bindweeds, amaranth, pigweeds, purslane, ragweed, and crab and barn grasses. Horned larks are among the most efficient weed-destroying birds.

FIG. 10.—Horned lark.

The insect food of these birds includes such pests as May beetles and their larvæ, the white grubs, leaf beetles injurious to strawberries, cabbage, melons, and sugar beets, clover-leaf and clover-root weevils, potato-stalk borers, nut weevils, bill bugs, and the chinch bug. Grasshoppers are a favorite food; cutworms are eaten freely.

The proportion of animal matter in the diet of the nestlings is about four times as large as in the adults. In the nestling state, therefore, horned larks are almost entirely beneficial and the number of insect pests they consume is very great.

The horned larks of California differ markedly in food habits from those of other parts of the country, being almost entirely vegetarian and, although the number examined constitutes a little more

than a fifth of the total, they consume half of all the grain eaten by the whole group. From this it might appear that the California birds are decidedly injurious, but it must not be forgotten that oats, which make up the bulk of their grain food, grow wild throughout the State, and it is probable that a great part of the oats consumed comes from the wild plants, the destruction of whose seed is a benefit.—W. L. M.

FIG. 11.—Chipping sparrow.

CHIPPING SPARROW.

(*Spizella passerina.*)

The chipping sparrow (fig. 11) occupies practically the whole of the United States and part of Canada during the breeding season. It winters in the Southern States and southward. This bird has endeared itself to the people of the country by its gentle and confiding manners, and by the fact that it does no mischief. Orchards, shade trees about houses, and open groves are its favorite haunts, and in such places it builds its nest. The bird usually lines its nest with coarse hair, a habit that has earned for it the rather common name, "hair bird."

For the investigation of the food of this bird some 300 stomachs were available. They were collected from all parts of the United

States and probably give a fair idea of the annual food of the "chippy." In the first analysis the food divides into 38 per cent of animal to 62 per cent of vegetable matter. Specimens from the west coast give a higher percentage of animal matter. From California 96 stomachs gave 45 per cent of animal food to 55 per cent of vegetable. In June the animal food rises as high as 93 per cent of the whole.

Beetles amount to 11 per cent of the food and consist of various families. In one stomach were found the remains of 30 snout beetles or weevils. Hymenoptera aggregate 11.8 per cent and in June attain to 67.5 per cent. They are represented mostly by ants, with a few wasps. Hemiptera (bugs) are eaten to an average extent of 7.5 per cent. They consist of stink bugs, leafhoppers, plant lice, and scales. Of the latter the black olive scale (*Saissetia oleæ*) was noted. Diptera (flies) do not seem to be a favorite food with the chipping sparrow. The aggregate per month is only 3 per cent. Caterpillars are evidently the favorite animal food, as they were eaten to an average extent of 14.2 per cent, or more than any other insect. They are eaten in every month and in May attain to 43.25 per cent of the food. Two stomachs contained pupæ of the codling moth. Grasshoppers appear in one stomach and, with a few spiders and some bits of eggshells, make up the remainder of the animal food.

Vegetable food.—Grain in the shape of oats constitutes about 4 per cent of the food of the eastern "chippies," but only 1 per cent for the western ones. In either, the amount is insignificant and is probably all waste grain. A mere trace of fruit was found in one stomach taken in June. Weed seed is eaten in every month of the year and amounts to 53 per cent of the year's food. In September it rises to 98 per cent, is but a little less in August, and practically keeps up to that mark till insects appear in the spring.

Summary.—This brief review of the food of the chipping sparrow emphasizes and confirms what almost everybody knew before—that the food habits are all good; that the bird does not attack any product of husbandry and does destroy many harmful insects. The bird is well worthy of the welcome and protection which it everywhere receives.—F. E. L. B.

JUNCO OR SNOWBIRD.

(*Junco hyemalis.*)

The junco or snowbird (fig. 12) is known as a breeding bird in the United States only near the northern border and elsewhere in the mountains. In fall it migrates southward and spreads over the whole country, where it remains during the winter, so that in most places it is known as a winter species. In the investigation of its food more

than 500 stomachs were examined. The food consists of 23 per cent of animal matter to 77 per cent of vegetable. This is the average diet for the year, but stomachs taken in the summer show a higher percentage of animal matter. Thus 65 stomachs collected in North Carolina and California in the three summer months show 49 per cent of animal matter.

FIG. 12.—Junco or snowbird.

Animal food.—Beetles amount to 6 per cent, and with the exception of two ladybirds (Coccinellidæ) not a useful species was identified among them. Weevils make up the bulk of the item, and a species of scolytid or engraver beetle (*Phlœosinus punctatus*) was found in one stomach. Hymenoptera are represented mostly by ants, with a few wasps, amounting in all to a little more than 2 per cent of the food. Caterpillars are apparently the favorite insect food, forming 9.4 per cent of the diet. One stomach taken in California in August contained 67 per cent of them. Bugs, grasshoppers, a few other insects, and spiders make up the remainder of the animal food, 7.3 per cent.

Vegetable food.—Seeds of blackberries or raspberries, with a little fruit pulp, were found in a few stomachs taken in the fall. This was so late in the season that they probably had no economic value.

Grain amounts to 8 per cent of the food. Oats, wheat, barley, and corn were identified. None of it was taken in a harvest month, though some may have been collected from newly sown fields in spring. The principal item of the junco's food, however, is weed seed. This amounts to 61.8 per cent, is eaten in every month, and in September amounts to 95 per cent.

Summary.—The insect food of the junco is composed almost entirely of harmful species, of which caterpillars form the largest item. Juncos do no damage to fruit or grain. They eat large quantities of weed seed, thereby rendering service to agriculture. They should be rigidly protected.—F. E. L. B.

FIG. 13.—White-crowned sparrow.

WHITE-CROWNED SPARROW.

(*Zonotrichia leucophrys.*)

The white-crowned sparrow (fig. 13) in one or other of its three subspecies, is found in winter over most of the southern and central United States west of Ohio, and casually or in migration considerably farther east. It breeds far to the north or well up in the mountains. These sparrows frequent valleys, brushy hillsides, highways, and cultivated fields. Something more than 600 stomachs of the three forms have been examined, but the summer months are sparsely represented. The first analysis of the contents gives 7.4 per cent of animal food to 92.6 per cent of vegetable.

Animal food.—Beetles, practically all of harmful species, amount to 1.4 per cent of the food. In June they reach nearly 8 per cent, but in the other months are insignificant. Hymenoptera amount to 1.9 per cent, reaching over 16 per cent in June, but in

the other months rising barely above 1 per cent. The most of them are ants with a less number of wasps and bees and a few parasitic species. Hemiptera amount to one-half of 1 per cent and were found in 11 stomachs, of which 5 contained black olive scales. The others were stink bugs, leafhoppers, and tree-hoppers. Caterpillars are the largest item of animal food and aggregate about 3.5 per cent. Most of them were eaten in July, when they constituted 37.5 per cent of the food.

Vegetable food.—Fruit amounts to 4.5 per cent. It consists of elderberries, blackberries or raspberries, figs, and cherries. In California this bird has been accused of eating buds from fruit trees to an injurious extent, but nothing was found in the stomachs to substantiate this charge. Grain aggregated 8.6 per cent, and was found in 69 stomachs, as follows: Oats in 56, wheat in 7, barley in 5, and corn in 1. It was mostly eaten in the three winter months, and so had no pecuniary value. Only 3.5 per cent was taken in March, which would indicate that not much was taken from newly sown fields.

Like many others of the sparrow family, the white-crown subsists largely upon weed seed, which is eaten freely in every month and amounts to 74 per cent of the annual food. Over 90 per cent of all the stomachs contained weed seed, and one was entirely filled with it. Over 30 species were identified, and several stomachs contained as many as 9 different species. The favorite variety appears to be the rough pigweed (*Amaranthus retroflexus*), which was found in 208 stomachs.

Summary.—Neither the farmer nor the fruit grower has much to fear from the white-crowned sparrow. On the contrary, the bird destroys some harmful insects and a vast number of seeds of noxious weeds. The fruit eaten is mostly wild and the grain either waste or volunteer. There is very little to substantiate the accusation that the bird destroys fruit buds.—F. E. L. B.

SOUTHERN BUTCHER BIRD.

(*Lanius ludovicianus.*)

The southern butcher bird (fig. 14), or loggerhead shrike, in some of its numerous forms, is found over much of the United States and is especially common on the Pacific coast. All the forms retire southward at the approach of winter and in many localities are replaced during the cold season by the northern butcher bird (*L. borealis*), which comes down from the north and winters in the United States. The butcher bird resembles a bird of prey in form of beak and to a certain extent in food habits, but has no such talons as enable the true birds of prey to seize their victim and hold it

securely while tearing it in pieces. Whenever butcher birds capture prey that must be torn apart, they press it firmly down into a sharp crotch, where it can readily be dissected. When food is abundant, surplus captures are hung, until needed, on thorns, sharp twigs, splinters, or the barbs of wire fences.

FIG. 14.—Southern butcher bird.

Like birds of prey and some other birds, the butcher bird habitually disgorges the indigestible part of its food after digesting the nutritive portion. The bones and hair of mice are rolled into compact pellets in the stomach before being disgorged.

For the investigation of the food of the southern butcher bird 124 stomachs of the western subspecies and 88 of the eastern were examined. The western birds showed 2.5 per cent of vegetable substances in their stomachs, but the eastern ones contained nothing but animal matter.

Animal food.—The animal portion of the food of western butcher birds consists of insects 83 per cent, spiders and a few snails 2 per cent, and vertebrates 12 per cent. The stomachs of the eastern forms show insects 68 per cent, spiders 4 per cent, and vertebrates 28 per cent. The difference is undoubtedly due to climate, the western bird being

able to find insects all the year round, while the eastern one gets very few during the winter. The largest item of insect food is Orthoptera (grasshoppers and crickets), which constitute 43 per cent of the stomach contents in the western bird and 39 per cent in the eastern one. They are eaten in every month of the year and in August and September reach nearly 70 per cent. Ordinary grasshoppers form the great bulk of this item of food, but a good many crickets are eaten, especially the brown and striped so-called "wood crickets." One group of these is especially noticeable—a group of large soft-bodied monsters of the genus *Stenopelmatus*, many of which live under dead leaves, stones, and rubbish and do not often voluntarily show themselves by the light of day.

Beetles collectively are second in importance in the butcher bird's insect food, amounting to 16 per cent for the western bird and somewhat more for the eastern. Of these about 7 per cent are ground beetles (Carabidæ) and carrion beetles (Silphidæ), and the remainder are harmful species. Most of the beetles eaten are the large species, but the butcher bird does not disdain small game, and a number of small leaf beetles and weevils were noted. Ants and wasps amount to a little more than 11 per cent in the food of the western subspecies and 3 per cent in that of the eastern one. In both, wasps far outnumber ants. Moths and caterpillars amount to 7 per cent for the western bird and 4 per cent for the eastern one. One western stomach was entirely filled with the remains of 15 moths, a most unusual occurrence, for adult Lepidoptera are but sparingly eaten by birds. Bugs and flies are eaten occasionally. In one stomach remains of robber flies (Asilidæ) were detected. These two orders and a few other odd insects constitute 5 per cent of the food.

Spiders and several kindred creatures form 2 per cent of the food of the western form, but though not eaten in any great quantities they appear in a good many stomachs. In one stomach was found one of those bristly and uncanny monstrosities of the animal world known as jointed spiders (Solpugida). The lingual ribbon of a snail was found in one stomach, and bits of what appeared to be the limbs of small crustaceans in several. In the eastern form, spiders amount to 4 per cent of the food. The vertebrate part of the butcher bird's food amounts to 12 per cent for the western bird and 28 per cent for the eastern one. It is made up of remains of mammals, birds, and reptiles. Of these, mammals, in the shape of mice and sometimes shrews, are by far the most numerous, and form a very important item in the diet of the eastern bird but less so in case of the western one. Comparatively few birds are taken. The reptiles are mostly lizards eaten by the western shrike.

Summary.—While the southern butcher bird eats a few birds and some useful insects, its diet is on the whole very much in its favor, as its consumption of grasshoppers far outweighs the harm to birds and beetles. As a feature of the landscape, and as lending animation to rural scenes, the shrike in California is a pronounced success and, while not so numerous in the East, it is just as attractive and is doing the same good by its food habits.—F. E. L. B.

AUDUBON WARBLER.

(*Dendroica auduboni.*)

The Audubon warbler (fig. 15) is well distributed over the western United States east to the Great Plains, breeding in the mountains and descending in winter to the valleys and plains. It is one of the most abundant of the western species and may be considered as typical of the genus, especially in the matter of food. In the winter season it is a frequenter of orchards, gardens, and dooryards, where it pursues its business of insect hunting with an assiduity worthy of all praise. At this season it is very familiar and easily approached.

FIG. 15.—Audubon warbler.

In the investigation of the food of the Audubon warbler 383 stomachs were examined. The contents were found to be made up of 84.74 per cent of animal food to 15.26 of vegetable.

Animal food.—The largest item of animal food is Hymenoptera (wasps and ants), which aggregate 26.19 per cent of the whole. By far the greater number of these are ants and, as plant lice were

also eaten, it is probable that many of the ants are of species that take care of plant lice. The other members of this order are rapid fliers and are probably mostly taken on the wing. Diptera (flies) were eaten to the extent of 16.42 per cent, which is a large record for any bird except a swallow or flycatcher. Like the Hymenoptera, most of them must have been taken on the wing in mid-air. Members of two families were identified: Muscidæ, the family of the common housefly, and crane flies or daddy longlegs (Tipulidæ). Most of the Diptera were of the smaller species, commonly known as gnats, which fly in swarms and are rather sluggish. Hemiptera (bugs) collectively amount to 19.61 per cent, of which a little more than 4 per cent are scales and plant lice. The black olive scale (*Saissetia oleæ*) and the greedy scale (*Aspidiotus rapax*) were found in 15 stomachs. Plant lice were contained in 39 stomachs and from their numbers would appear to be a favorite food. Several stomachs were entirely filled with them, and the stomachs in which they were found contained an average of 71 per cent in each. The remainder of the hemipterous food, over 15 per cent, is made up of stinkbugs, leafhoppers, and tree-hoppers, with some unidentified remains.

Caterpillars form a small but rather regular article of diet with the Audubon warbler. They amount to 14.22 per cent, though this figure includes a few adult moths and a few chrysalides. Beetles of all kinds aggregate 6.70 per cent and, except a few carrion and ladybird beetles, are of injurious species. Snout beetles, or weevils, were the most important. A few other insects and some spiders, in all 1.60 per cent, make up the rest of the animal food.

Vegetable food.—The vegetable food of the Audubon warbler consists of fruit, weed seed, and a few miscellaneous substances. As the bird does not visit the fruit-growing regions during the fruit season, it can not injure cultivated crops. Most of the fruit it eats is wild and of no value, though in the fall it probably feeds to some extent upon the belated products of the orchard. The total of fruit eaten is less than 5 per cent, most of which is taken in fall and early winter. The largest item of vegetable diet, however, is weed seed. This is eaten to the extent of 9.16 per cent of the food and is taken in nearly every month, but especially in winter. One of the most important seeds eaten by the Audubon warbler is that of the poison oak (*Rhus diversiloba*). Usually this bird does not eat the whole seed, but only the waxy outer coating, and hence does not materially aid in the distribution of these noxious plants. In addition to the foregoing, rubbish to the extent of 2 per cent was found.

Summary.—Evidently this bird is a valuable asset in the garden and orchard. The great bulk of its food, both animal and vegetable, is composed of elements whose destruction is a benefit to the farmer.—F. E. L. B.

RUBY-CROWNED KINGLET.

(*Regulus calendula.*)

The ruby-crowned kinglet (fig. 16) is known on the Pacific coast most commonly as a winter visitant, though it breeds in summer on the high mountains. In the eastern United States it is usually seen chiefly in migration as it passes beyond our northern border to breed; but it also winters in the Southern States.

FIG. 16.—Ruby-crowned kinglet.

For the investigation of the food of this kinglet 294 stomachs were available. The food consists of 94 per cent of animal matter to 6 per cent of vegetable. The animal food consists of insects, spiders, and pseudoscorpions; the vegetable, of fruit and weed seeds.

Animal food.—Hymenoptera in the shape of wasps and ants appear to be the favorite animal food and aggregate 32.42 per cent of the whole. Hemiptera (bugs) are next in importance, and constitute 25.72 per cent of the diet. They include assassin bugs, lace bugs, leaf bugs, leaf hoppers, jumping plant lice, plant lice, mealy bugs, and scale insects. All except the first of these are harmful and some of them are pests when abundant, and being of small size are not easily dealt with by human devices.

Beetles of various families and species were eaten by the kinglet to the extent of 13 per cent of the food. With the exception of a few ladybirds all are of more or less harmful species. Of these the weevils or snout beetles are the most interesting. One stomach contained 20 individuals, which seem a large meal in view of the small size of the bird. Many of the weevils belong to the family of engravers (Scolytidæ), which live under the bark of forest trees and do much michief. Lepidoptera, both larvæ (caterpillars) and adult forms (moths and butterflies) constitute only a small part of the kinglet's diet. While a few caterpillars are eaten, most of the lepidopterous food consists of the minute cocoons of tineid moths, a family of immense size, with wide distribution, and destructive habits. They are largely leaf miners and do much damage to fruit and forest trees. Lepidoptera aggregate only 3 per cent of the food.

Diptera (flies) constitute 16.93 per cent of the whole food, but are very unevenly distributed. The greatest amounts were found in stomachs taken in January and February. A number of stomachs were nearly filled with these insects, which had probably been found hibernating in some cranny. Two stomachs contained remains of grasshoppers and these, with 2 per cent of spiders and pseudoscorpions, make up the remainder of the animal food.

Vegetable food.—Fruit was found in the stomachs of kinglets to the amount of less than 1 per cent and most of it was elderberries (*Sambucus*). Weed seed also was found to the extent of less than 1 per cent. The great bulk of the vegetable food was the seeds of poison oak and leaf galls, which together amount to something more than 4 per cent.

Summary.—As the food of the kinglet consists so largely of insects and these are mostly of noxious species, it follows that this bird, small as it is, is an important factor in keeping the great flood of insect life within proper limits. Its vegetable food contains no useful elements and its small size, which precludes the possibility of doing much harm to the products of industry, just fits it to cope with those minute pests against which man often finds himself so powerless.—F. E. L. B.